



Bull Run TREATMENT PROJECTS

Exterior Site Lighting Analysis Finish Water Intertie Facility

Subject: Site Lighting Memorandum

Project #s: **PWB:** W02229 **Jacobs** D3460500

Date: September 2, 2022

To: Ken Ackerman, P.E., Project Manager
Portland Water Bureau

From: Morgan MacRostie, P.E., Electrical Engineer



Signed on: 9/6/22

Jacobs

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1.0 Introduction

The purpose of this memorandum is to provide the analysis of site lighting at the Finish Water Intertie of the City of Portland’s Water Bureau (Water Bureau) Facility Pipelines project. The analysis provides a description of exterior lighting being proposed at this site, as well as defining the locations, showing the light levels, and providing supplementary information.

1.1 Client Requirements – Exterior Lighting

The Water Bureau’s standards for exterior lighting used for the design and analysis is as follows:

“The Exterior lighting will be laid out to minimize any impacts to future site expansions, both above and below grade. Exterior lights will be sharp cut-off type to minimize light trespass outside the facility site. Exterior lighting will be designed and laid out in order to attain the LEED exterior light pollution credit (...). Exterior roadway and area lighting will be light-emitting diode (LED) technology. At entrances to buildings, lighting will be light-emitting diode (LED) technology.”

2.0 Proposed Exterior Lighting Design

2.1 Proposed Luminaires

Per the Luminaire Schedule in the Schematic (30%) Design Documents and as provided in Table 2-1 below, the following luminaires are being proposed for the Intertie Facility. Data sheet/specifications for these luminaries are provided in Attachments A & B. Type M1 in the table are scheduled to be mounted to the side of the electrical building, whereas the Type S1 are pole mounted luminaires. The two pole mounted lights will be 18-feet off the ground. The exterior lighting will be on switches to allow independent operations of the building to pole lights. Commonly, only the Type M1 luminaire would be energized in the evenings, whereas the pole mounted S1 lights would only be energized when needed for maintenance activities occurring at night, which would be seldom.

Table 2-1. Exterior Luminaire Schedule		
Basis of Design (Manufacturer/Model)	Lamps	Voltage / Input Watts
Type M1 – Lithonia WST LED P1 30K VF MVOLT DDBXD	LED 3000K	120/11
Type S1 – Lithonia D-Series Size 0 DSX0 LED P1 30K RCCO MVOLT DDBTXD	LED 3000K	120/38

2.2 Site Layout, Design, and Calculations

The exterior lighting layout for the Intertie Facility has been designed with the rural site location, safety, security, and lighting trespass in mind. As a part of the project, two pole mounted lights are

included and located such that between them and the wall mounted light on the electrical building, the minimum required footcandles, meeting Illuminating Engineering Society (IES) Standards, are provided across the site, including the area atop the vault roof, where multiple access hatches are located. Lighting calculations, including maximum, minimum, and average footcandles for specific areas and overall site, are included in Attachment C. In addition, a rendering of the site lighting has been provided and included in Attachment D. Lastly, the Site Lighting Plan, consisting of the lighting layout, luminaire schedule, and fixture type, is included in Attachment E.

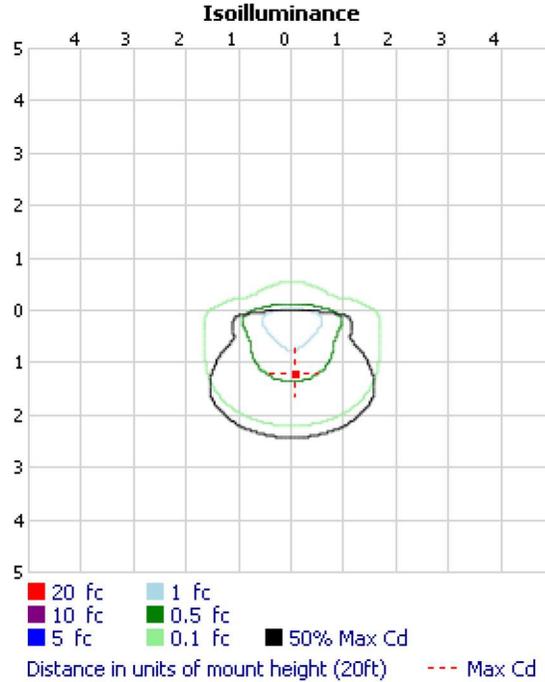
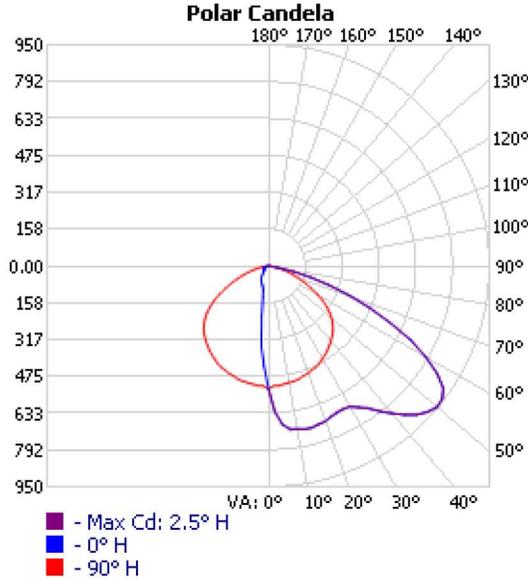
As shown on the attachments, when all the lights are energized, there is no light trespass outside of the Finish Water Intertie site boundary.

Attachment A: M1 Exterior Wall Mounted Luminaire

OUTDOOR PHOTOMETRIC REPORT

CATALOG: WST LED P1 30K VF MVOLT

Test #: ISF 30965P5
 Test Lab: SCALED PHOTOMETRY
 Test Date: 5/16/2016
 Catalog: WST LED P1 30K VF MVOLT
 Description: WST LED, Performance package 1, 3000 K, visual comfort forward throw, MVOLT
 Series: WST-LED
 Lamp: LED
 Lamp Output: Total luminaire Lumens: 1529.2, **absolute photometry ***
 Ballast / Driver: LED DRIVER
 Input Wattage: 12
 Luminous Opening: Rectangle (L: 7.56", W: 12")
 Max Cd: 945.3 at Horizontal: 2.5°, Vertical: 50°
 Roadway Class: VERY SHORT, TYPE III



*Test based on absolute photometry where lamp lumens=lumens total.
 *Cutoff Classification and efficiency cannot be properly calculated for absolute photometry.

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OUTDOOR PHOTOMETRIC REPORT
 CATALOG: WST LED P1 30K VF MVOLT



Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	356.7	23.3%
0-40	590.8	38.6%
0-60	1,186.6	77.6%
60-90	342.6	22.4%
70-100	109.6	7.2%
90-120	0.000	0%
0-90	1,529.2	100%
90-180	0.000	0%
0-180	1,529.2	100%

Lumens Per Zone

Zone	Lumens	% Total	Zone	Lumens	% Total
0-10	47.9	3.1%	90-100	0.000	0%
10-20	124.1	8.1%	100-110	0.000	0%
20-30	184.7	12.1%	110-120	0.000	0%
30-40	234.2	15.3%	120-130	0.000	0%
40-50	287.2	18.8%	130-140	0.000	0%
50-60	308.6	20.2%	140-150	0.000	0%
60-70	233.0	15.2%	150-160	0.000	0%
70-80	99.3	6.5%	160-170	0.000	0%
80-90	10.3	0.7%	170-180	0.000	0%

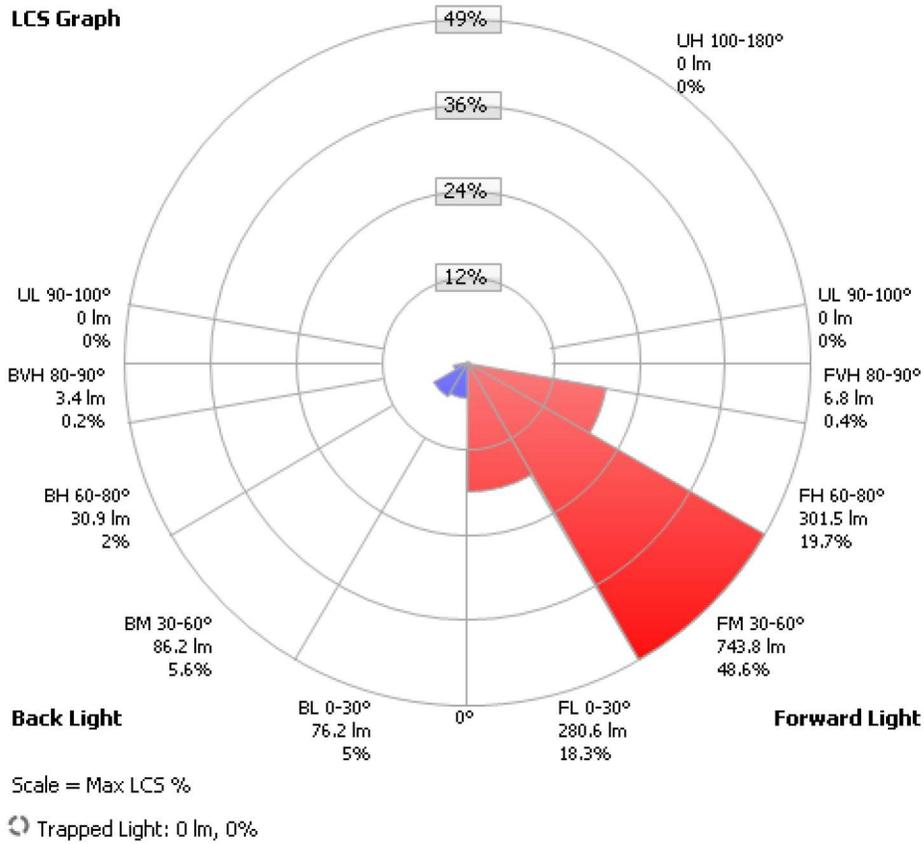
Roadway Summary

Distribution:	TYPE III, VERY SHORT	
Max Cd, 90 Deg Vert:	0.000	
Max Cd, 80 to <90 Deg:	72.4	
	Lumens	% Lamp
Downward Street Side:	1,332.7	87.1%
Downward House Side:	196.6	12.9%
Downward Total:	1,529.3	100%
Upward Street Side:	0.000	0%
Upward House Side:	0.000	0%
Upward Total:	0.000	0%
Total Lumens:	1,529.3	100%

LCS Table

BUG Rating	B0 - U0 - G0	
	Lumens	Lumens %
Forward Light		
Low(0-30):	280.6	18.3%
Medium(30-60):	743.8	48.6%
High(60-80):	301.5	19.7%
Very High(80-90):	6.8	0.4%
Back Light		
Low(0-30):	76.2	5%
Medium(30-60):	86.2	5.6%
High(60-80):	30.9	2%
Very High(80-90):	3.4	0.2%
Uplight		
Low(90-100):	0.000	0%
High(100-180):	0.000	0%
Trapped Light:	0.000	0%

OUTDOOR PHOTOMETRIC REPORT
CATALOG: WST LED P1 30K VF MVOLT



OUTDOOR PHOTOMETRIC REPORT
 CATALOG: WST LED P1 30K VF MVOLT



Candela Table - Type C

	0	15	25	35	45	55	65	75	85	90	105	115	125	135	145	155	165	175	180	
0	528	528	528	528	528	528	528	528	528	528	528	528	528	528	528	528	528	528	528	528
5	682	678	676	668	658	639	622	593	547	517	464	434	409	389	371	356	349	344	343	
10	712	707	709	706	699	685	669	628	563	509	409	356	302	232	183	157	143	134	136	
15	720	713	718	708	701	693	682	650	572	504	358	257	163	121	105	98	94	93	92	
20	711	706	706	700	697	689	681	658	574	492	302	162	109	94	89	85	81	81	81	
25	697	691	686	681	677	675	668	653	574	479	228	118	92	83	78	74	71	71	71	
30	697	688	671	654	644	644	646	635	565	461	169	98	83	74	69	65	62	60	60	
35	745	726	691	647	613	604	612	610	550	441	134	87	74	65	58	52	45	43	43	
40	825	797	747	677	612	570	564	570	523	418	113	79	66	54	43	36	31	29	29	
45	904	870	812	734	637	552	522	526	492	393	100	71	56	43	32	27	25	24	24	
50	944	907	847	767	668	552	478	469	444	356	90	63	45	32	26	25	25	24	24	
55	917	887	836	756	658	540	436	397	380	304	81	54	35	27	25	23	22	21	21	
60	777	768	738	689	601	488	382	317	297	241	69	43	30	25	23	22	22	21	21	
65	575	572	572	545	492	404	312	241	214	175	56	34	27	24	21	21	20	20	20	
70	373	372	372	366	341	297	228	169	139	114	42	28	22	20	19	19	19	18	18	
75	185	190	192	194	192	173	140	102	81	67	27	21	18	16	16	17	18	17	16	
80	38	43	54	65	72	71	63	47	38	31	16	13	13	12	13	14	14	14	14	
85	1	0	1	2	2	5	9	9	9	8	7	5	5	5	5	4	4	2	3	
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

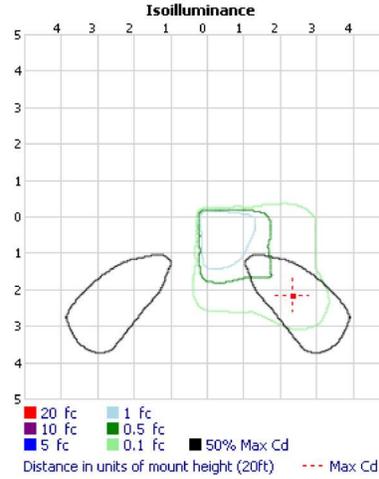
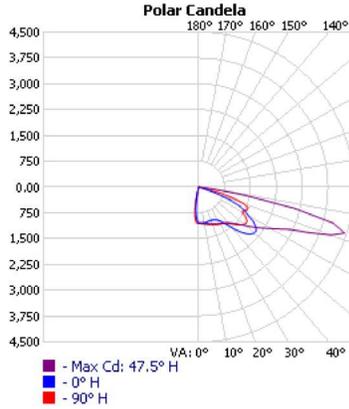
Attachment B: S1 Pole Mounted Luminaire

Jacobs

OUTDOOR PHOTOMETRIC REPORT
CATALOG: DSX0 LED P1 30K RCCO MVOLT



Test #: ISF 34144P1
Test Lab: SCALED PHOTOMETRY
Test Date: 3/27/2017
Catalog: DSX0 LED P1 30K RCCO MVOLT
Description: DSX0 LED P1 30K RCCO MVOLT
Series: D-Series Area Size 0
Lamp Catalog: NICHIA 319A 501-00582-005 PCBA LEM-30 4000K 319A 70 CRI
Lamp: LED
Lamp Output: Total Luminaire Lumens: 2668, absolute photometry *
Ballast / Driver: LED Driver
Input Wattage: 38
Luminous Opening: Rectangle (L: 7.92", W: 12.96")
Max Cd: 4,433.9 at Horizontal: 47.5°, Vertical: 72.5°
Roadway Class: MEDIUM, TYPE IV



*Test based on absolute photometry where lamp lumens=lumens total.
*Cutoff Classification and efficiency cannot be properly calculated for absolute photometry.

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ISF 34144P1
VISUAL PHOTOMETRIC TOOL

OUTDOOR PHOTOMETRIC REPORT
 CATALOG: DSX0 LED P1 30K RCCO MVOLT



Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	448,5	16,8%
0-40	719,5	27%
0-60	1,647,4	61,7%
60-90	1,020,6	38,3%
70-100	472,9	17,7%
90-120	0,000	0%
0-90	2,668,0	100%
90-180	0,000	0%
0-180	2,668,0	100%

Lumens Per Zone

Zone	Lumens	% Total	Zone	Lumens	% Total
0-10	88,6	3,3%	90-100	0,000	0%
10-20	162,5	6,1%	100-110	0,000	0%
20-30	197,4	7,4%	110-120	0,000	0%
30-40	271,0	10,2%	120-130	0,000	0%
40-50	403,5	15,1%	130-140	0,000	0%
50-60	524,4	19,7%	140-150	0,000	0%
60-70	547,6	20,5%	150-160	0,000	0%
70-80	379,6	14,2%	160-170	0,000	0%
80-90	93,3	3,5%	170-180	0,000	0%

Roadway Summary

Distribution:	TYPE IV, MEDIUM	
Max Cd, 90 Deg Vert:	0,000	
Max Cd, 80 to <90 Deg:	1,950,9	
	Lumens	% Lamp
Downward Street Side:	2,410,1	90,3%
Downward House Side:	258,3	9,7%
Downward Total:	2,668,3	100%
Upward Street Side:	0,000	0%
Upward House Side:	0,000	0%
Upward Total:	0,000	0%
Total Lumens:	2,668,3	100%

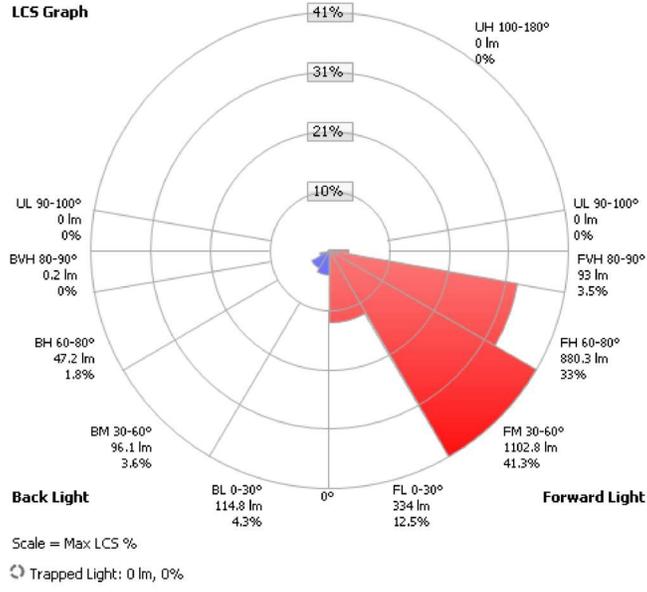
LCS Table

BUG Rating	B1 - U0 - G1	
Forward Light	Lumens	Lumens %
Low(0-30):	334,0	12,5%
Medium(30-60):	1,102,8	41,3%
High(60-80):	880,3	33%
Very High(80-90):	93,0	3,5%
Back Light		
Low(0-30):	114,8	4,3%
Medium(30-60):	96,1	3,6%
High(60-80):	47,2	1,8%
Very High(80-90):	0,2	0%
Uplight		
Low(90-100):	0,000	0%
High(100-180):	0,000	0%
Trapped Light:	0,000	0%

OUTDOOR PHOTOMETRIC REPORT
CATALOG: DSX0 LED P1 30K RCCO MVOLT



LCS Graph



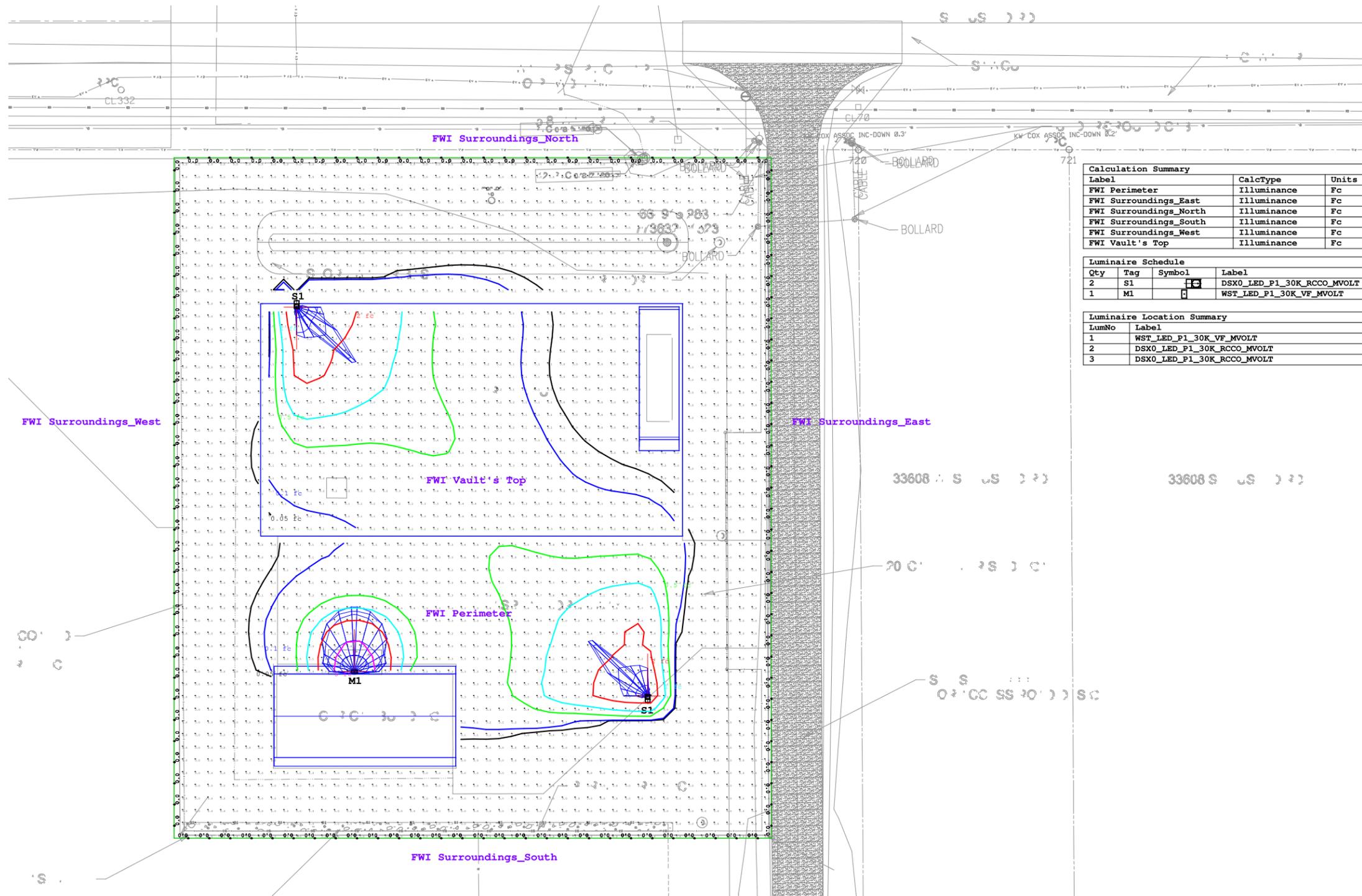
OUTDOOR PHOTOMETRIC REPORT
CATALOG: DSX0 LED P1 30K RCCO MVOLT



Candela Table - Type C

	0	15	25	35	45	55	65	75	85	90	105	115	125	135	145	155	165	175	180	195	205	215	225	235	245	255	265	275	2	
0	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046	1046
5	1047	1063	1064	1068	1071	1068	1068	1070	1062	1056	1044	1027	999	969	938	907	883	875	852	886	900	920	934	954	966	978	977	1001	1001	
10	1048	1066	1071	1079	1088	1089	1092	1097	1091	1082	1031	940	817	705	582	501	439	409	391	442	460	528	569	589	619	625	622	645	645	
15	1032	1058	1073	1095	1109	1121	1128	1135	1130	1116	986	779	541	333	198	104	73	58	53	67	93	131	162	193	199	182	165	154	154	
20	1028	1054	1071	1104	1134	1157	1167	1178	1172	1159	912	564	252	73	24	9	3	1	0	0	1	5	6	8	5	5	5	8	8	
25	1049	1078	1090	1125	1168	1200	1212	1220	1216	1198	790	325	60	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	1108	1137	1142	1173	1210	1252	1260	1266	1256	1237	643	123	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	1278	1294	1259	1268	1270	1308	1323	1324	1306	1287	480	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	1585	1597	1542	1465	1369	1374	1406	1414	1403	1379	294	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	1905	1926	1873	1744	1537	1469	1534	1574	1570	1541	131	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	2085	2151	2125	1992	1784	1671	1720	1760	1739	1687	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	2025	2179	2206	2161	2065	1941	1868	1853	1774	1710	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	1677	1922	2034	2154	2388	2189	1844	1694	1537	1462	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	1323	1557	1786	2260	2901	2513	1778	1739	1624	1550	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	598	843	1195	2315	3995	3243	1843	1582	1401	1362	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	84	149	349	2123	3941	3301	1222	729	550	601	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	31	82	372	1951	1468	1385	1020	169	64	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85	10	58	602	940	235	227	734	216	25	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Attachment C: Exterior Light Level Calculations

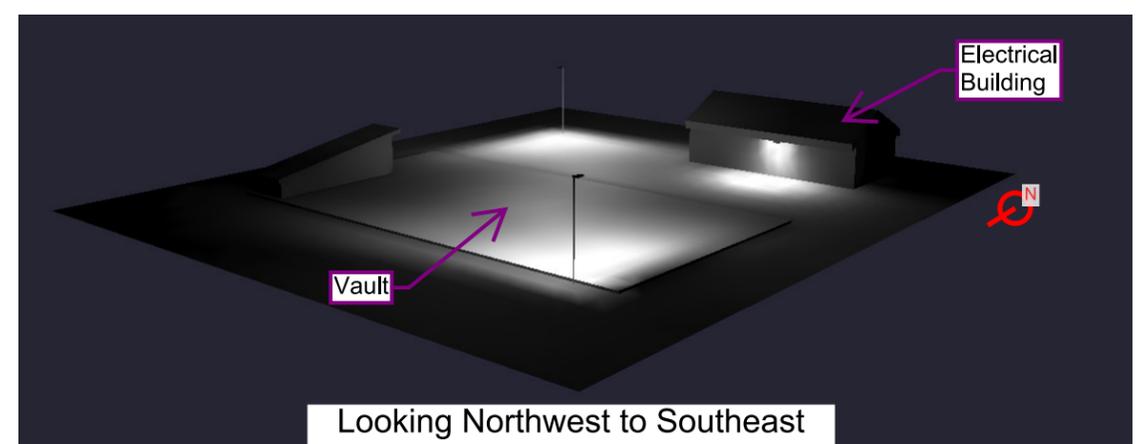
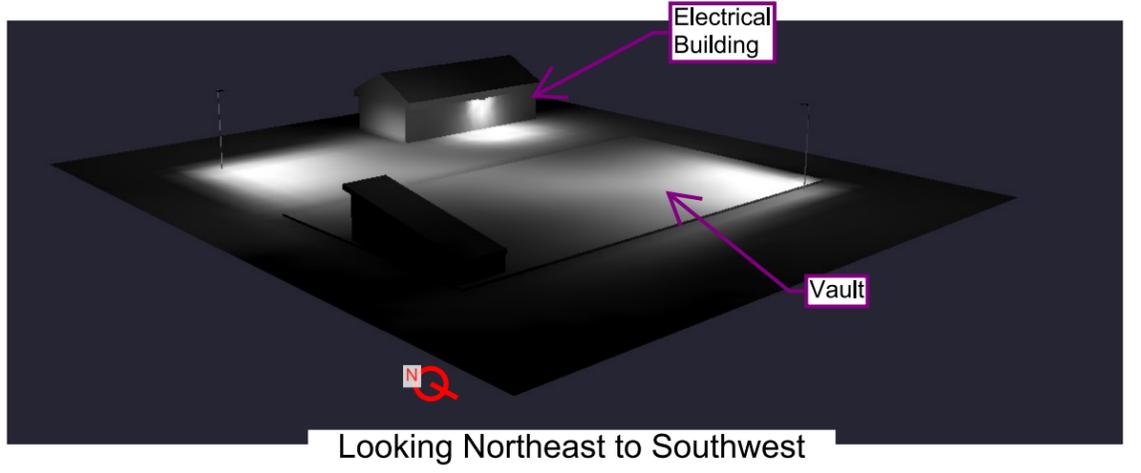
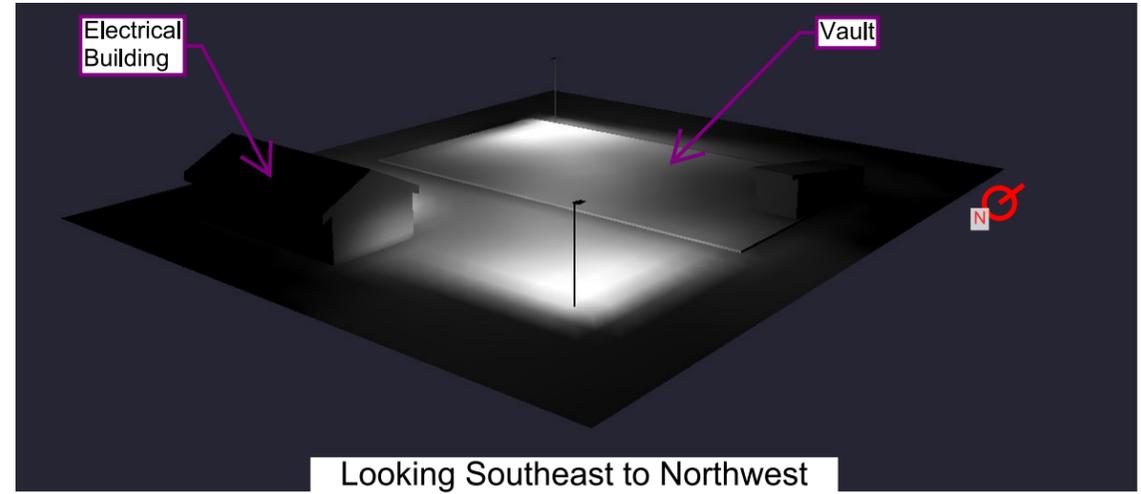
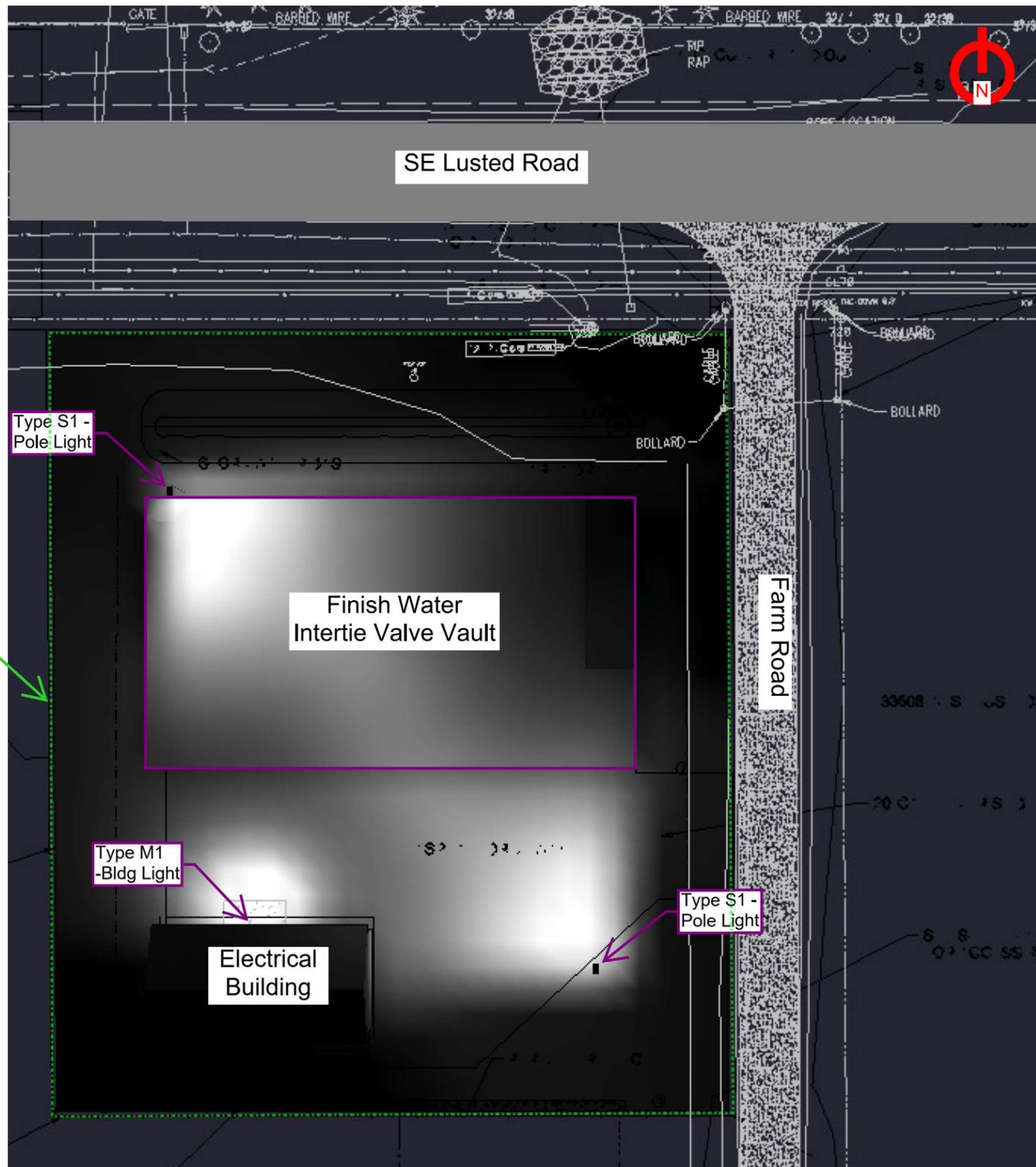


Calculation Summary						
Label	CalcType	Units	Avg	Max	Min	Grid Z
FWI Perimeter	Illuminance	Fc	0.21	9.3	0.0	0.1
FWI Surroundings_East	Illuminance	Fc	0.00	0.0	0.0	0 to 50
FWI Surroundings_North	Illuminance	Fc	0.00	0.0	0.0	0 to 50
FWI Surroundings_South	Illuminance	Fc	0.00	0.0	0.0	0 to 50
FWI Surroundings_West	Illuminance	Fc	0.00	0.0	0.0	0 to 50
FWI Vault's Top	Illuminance	Fc	0.45	3.2	0.0	0.6

Luminaire Schedule							
Qty	Tag	Symbol	Label	Description	LLF	Lum. Watts	Lum. Lumens
2	S1		DSX0_LED_P1_30K_RCCO_MVOLT	DSX0 LED P1 30K RCCO MVOLT	0.900	38	2669
1	M1		WST_LED_P1_30K_VF_MVOLT	WST LED P1 30K VF MVOLT	0.900	12	1530

Luminaire Location Summary		
LumNo	Label	Z
1	WST_LED_P1_30K_VF_MVOLT	8.5
2	DSX0_LED_P1_30K_RCCO_MVOLT	18
3	DSX0_LED_P1_30K_RCCO_MVOLT	18

Attachment D: Exterior Renderings



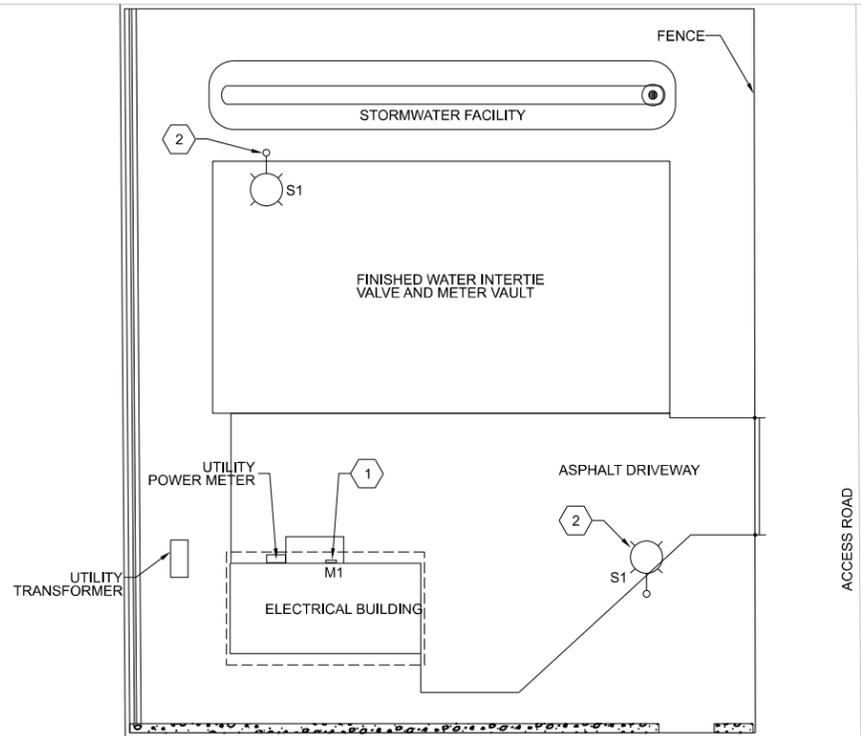
Attachment E: Site Lighting Plan

GENERAL SHEET NOTES

1. ALL LUMINAIRES POWERED FROM PANELBOARD LOCATED IN THE ELECTRICAL ROOM

SHEET KEYNOTES

1. SURFACE MOUNTED LIGHT SCNCE.
2. POLE MOUNTED LUMINAIRE, POLE HEIGHT 15'.



LIGHTING PLAN

1"=20'

LUMINAIRE SCHEDULE							
TYPE	VOLTAGE	INPUT WATTS	DESCRIPTION	BASIS OF DESIGN	LAMPS	MOUNTING	
M1	M1	120	12	WALL MOUNTED ARCHITECTURAL WALL SCNCE. ALUMINUM HOUSING. FULL CUTOFF OPTICS. DARK BRONZE FINISH. MOTION/AMBIENT SENSOR, AMBIENT ENABLED AT 1FC.	LITHONIA WST LED WST LED P1 30K VF MVOLT DDBX PIR1FC3V OR APPROVED EQUAL	LED 3000K	WALL MOUNT
S1	S1	120	38	PRECISION-MOLDED PROPRIETARY ACRYLIC LENSES. SINGLE-PIECE DIE-CAST ALUMINUM HOUSING. COMPLETELY SEALED AGAINST MOISTURE AND ENVIRONMENTAL CONTAMINANTS (IP65). MOTION/AMBIENT SENSOR, AMBIENT ENABLED AT 1FC. 15'-0" X 4" SQUARE ALUMINUM POLE. DARK BRONZE FINISH.	LITHONIA D-SERIES SIZE 0 DSX0 LED P1 30K RCCO SPA DDBTXD MVOLT PIR1FC3V OR APPROVED EQUAL	LED 3000K	POLE MOUNT

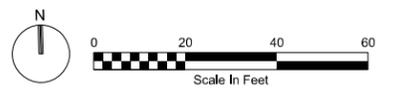
LUMINAIRE SCHEDULE



M1. LITHONIA WST LED WALL MOUNT LIGHT



S1. LITHONIA D-SERIES POLE LIGHT



KEYPLAN

No	Date	Description	Appd
Revisions			
Survey			

**PRELIMINARY
NOT FOR
CONSTRUCTION**

Designed By	DG	Program Mgr	XXX
Drawn By	DG	Const Mgr	XXX
Checked By	BN	Const Supvr	XXX
Project Mgr	XXX	Date	6/30/22

WARNING



If this bar does not measure 1" then the drawing is not to scale



Date

Date



**Bull Run Filtration Pipelines
FINISHED WATER INTERTIE
SITE LIGHTING PLAN**

SAP Project No
W02563

1/4 Section

Sheet No

LU-553

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